DNMT3A gene

DNA methyltransferase 3 alpha

Normal Function

The *DNMT3A* gene provides instructions for making an enzyme called DNA methyltransferase 3 alpha. This enzyme is involved in DNA methylation, which is the addition of methyl groups, consisting of one carbon atom and three hydrogen atoms, to DNA molecules. In particular, the enzyme helps add methyl groups to DNA building blocks (nucleotides) called cytosines.

DNA methylation is important in many cellular functions. These include determining whether the instructions in a particular segment of DNA are carried out or suppressed (gene silencing), regulating reactions involving proteins and fats (lipids), and controlling the processing of chemicals that relay signals in the nervous system (neurotransmitters). DNA methyltransferase 3 alpha is particularly important for establishing the initial locations for methylation during development. The enzyme also functions in early cells that can give rise to more mature cell types. In early blood cells, called hematopoietic stem cells, the methylation patterns established by DNA methyltransferase 3 alpha promote maturation (differentiation) into different blood cell types.

Health Conditions Related to Genetic Changes

cytogenetically normal acute myeloid leukemia

Mutations in the *DNMT3A* gene are associated with a form of blood cancer known as cytogenetically normal acute myeloid leukemia (CN-AML). While large chromosomal abnormalities can be involved in the development of acute myeloid leukemia, about half of cases do not have these abnormalities; these are classified as CN-AML. Up to one-third of people with CN-AML have a mutation in the *DNMT3A* gene.

The *DNMT3A* gene mutations involved in CN-AML are called somatic mutations; they are found only in cells that become cancerous and are not inherited. Most change single protein building blocks (amino acids) in the DNA methyltransferase 3 alpha enzyme. Studies suggest that these changes make the enzyme less able to fully methylate DNA. It is also thought that the altered pattern of methylation in cells changes the activity of several genes; some genes that are normally silenced may be turned on. Researchers speculate that the altered gene activity prevents hematopoietic stem cells from differentiating normally, which leads to the overproduction of abnormal, immature white blood cells characteristic of acute myeloid leukemia.

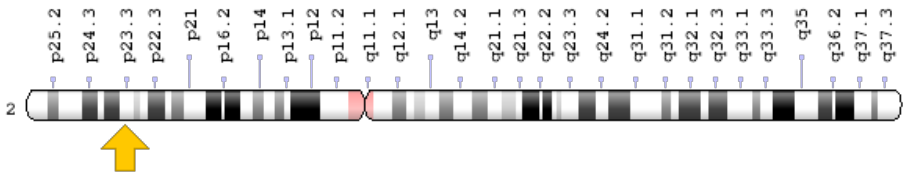
other cancers

Somatic *DNMT3A* gene mutations are also found relatively frequently in another form of blood cancer called T-cell acute lymphoblastic leukemia. As in CN-AML, the mutations disrupt the normal pattern of methylation in cells, which blocks differentiation. It is unclear why some people with *DNMT3A* gene mutations develop acute myeloid leukemia and others develop acute lymphoblastic leukemia.

Chromosomal Location

Cytogenetic Location: 2p23.3, which is the short (p) arm of chromosome 2 at position 23.3

Molecular Location: base pairs 25,232,961 to 25,342,590 on chromosome 2 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- DNA (cytosine-5-)-methyltransferase 3 alpha
- DNA (cytosine-5)-methyltransferase 3A
- DNA cytosine methyltransferase 3A2
- DNA MTase HsaIIIA
- DNM3A_HUMAN
- DNMT3A2
- M.HsaIIIA

Additional Information & Resources

Educational Resources

- Madame Curie Bioscience Database: DNA-Methylation https://www.ncbi.nlm.nih.gov/books/NBK45032/#ch4689.s5

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28DNMT3A%5BTI%5D%29+OR+%28DNA-methyltransferase+3a%5BTI%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+720+days%22%5Bdp%5D

OMIM

- DNA METHYLTRANSFERASE 3A
  http://omim.org/entry/602769
- LEUKEMIA, ACUTE LYMPHOBLASTIC
  http://omim.org/entry/613065

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/DNMT3AID40349ch2p23.html
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=DNMT3A%5Bgene%5D
- HGNC Gene Family: PWWP domain containing
  http://www.genenames.org/cgi-bin/genefamilies/set/1147
- HGNC Gene Symbol Report
  http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=2978
- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/1788
- UniProt
  http://www.uniprot.org/uniprot/Q9Y6K1

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